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OBSERVATIONS ON THE FELDSPARS

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A PECULIAR PERTHITE FROM PORT HENRY, N.Y.[1]

An interesting variation of the albite-microcline intergrowth known as perthite was noticed among some specimens obtained from a mineral dealer. The body of the specimen is pale flesh-red microcline. On the basal pinacoidal {010} cleavage there are two intersecting sets of narrow, colorless albite strips, which are plates inserted parallel to the unit prism {110} (Fig. 1). The peculiarity is that the two sets of albite plates are twinned with respect to each other on the albite law. This can be demonstrated by holding a specimen with the basal cleavage close to the eye. A reflection being obtained from the microcline cleavage, on revolving the specimen about the *a*-axis a little toward one, there is a reflection from the albite plates parallel to the (110) face, and on revolving it a little in the opposite direction, there is a reflection from the albite plates parallel to the $(1\bar{1}0)$ face. In each case the reflection is from the basal {001} cleavage. The angle between the (001)

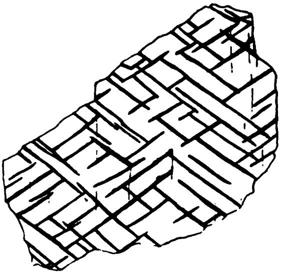

FIG. 1.—Peculiar perthite (½ natural size).

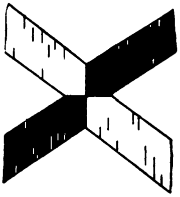

FIG. 2.—Albite from perthite (magnified).

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[1] This perthite, as well as the albite described in the next item, are evidently from pegmatites. See Kemp. *Trans. Am. Inst. Min. Eng.*, XXVI, 195 (1897).

face of the microcline and the (001) face of albite on each side is $3\frac{1}{2}^\circ$ as measured with the simple reflection goniometer.

A microscopic examination confirms the above. A section parallel to the base {001} shows the gridiron structure for the microcline and plates of albite with extinction angles of about $3\frac{1}{2}^\circ$. The albite plates parallel to the (110) face have extinction in the opposite direction from those parallel to the (1$\bar{1}$0) face. Close examination reveals a few narrow twin lamellae in each set of albite plates. Fig. 2 is a diagrammatic drawing of a thin section cut parallel to (001).

The question arises as to whether this intergrowth can be called perthite or not. In the original perthite the albite plates are polysynthetically twinned and are parallel or approximately parallel to the *a*-axis. There is before me a specimen from the original locality, Perth, Canada (Fig. 3), which shows a coalescence of albite plates practically forming a plate parallel to the (110) face. I have also noted albite plates parallel to (110) in microcline-perthite from Rincon, Cal. On account of the gradation between the typical perthite and the peculiar perthite, it seems advisable to extend the term perthite to cover such cases. It should also be mentioned that normal perthite occurs among the Port Henry specimens. These specimens consist of microcline with plates of albite set parallel to the {100} face. They show polysynthetic albite twinning.

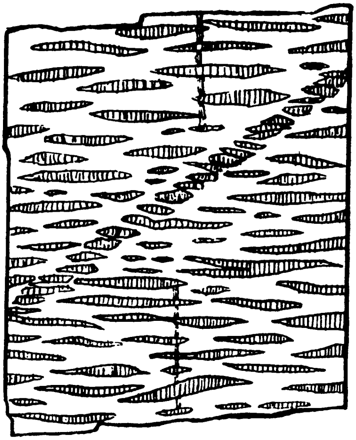

FIG. 3.—Perthite

ALBITE WITH BRACHYPINACOIDAL PARTING

Some cleavable albite of pale-green color from Port Henry, N.Y., consists of two kinds of specimens. Part of the specimens break in plates parallel to basal {010} cleavage while others break in plates parallel to the side pinacoid {010} and have a lamellar structure. In albite the basal cleavage is perfect and the side pinacoidal cleavage, imperfect, hence the lamellar specimens are abnormal. A close examination of the two kinds of specimens shows polysynthetic twinning according to the albite law. In the basal cleavage of the first-mentioned variety the twinning lamellae are fairly uniform. Fig. 4 represents the basal cleavage of the variety with lamellar structure. Most of the twinning lamellae are very narrow, but every fifth to tenth one is much wider. On tracing the wider lamellae to the edge of the specimen there is usually noticed a parting plane. These parting planes are covered with a thin film of chlorite. In a specimen about 1 cm. wide there are about twenty-two broad lamellae and about twenty parting planes. The films of chlorite are probably the result, not the primary cause, of the parting, for the normal albite has finely divided chlorite all through it and not concentrated in films.

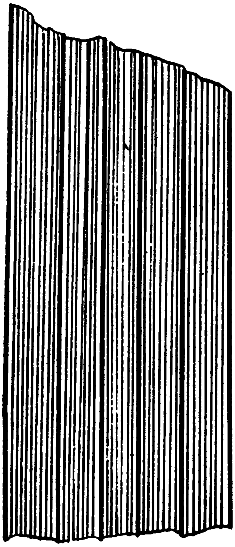
FIG. 4.—Albite twinning on albite (magnified).

If my observations are correct, there is both cleavage and parting in the same direction, namely, parallel to {010}. I know of no other similar case on record but there seems to be no reason why the same direction cannot be one of molecular disturbance as well as one of weak cohesion.

PERICLINE PARTING IN PLAGIOCLASE

Cleavable white plagioclase from Amelia Co., Va., shows a dull surface with bright spots. The bright spots are cleavage surfaces parallel to the base {001}. The dull surface is a plane of separation parallel to the rhombic section, for pericline twin lamellae are visible on the imperfect {010} cleavage. A glass slip was cemented on the dull surface and the angle between it and the cleavage measured with the reflecting goniometer. The angle is +9°, which places the plagioclase as albite-oligoclase, Ab_6An_1. Fig. 5 is a side elevation showing the cleavage, parting, and pericline twin lamellae.

I also have a specimen of albite from Auburn, Me., which shows pericline parting. The angle between the cleavage and the parting is +13°, as nearly as can be measured with a contact goniometer, which places it as about Ab_{12} An_1. In this specimen there is pericline twinning as well as albite twinning and good cleavage parallel to $\{001\}$, $\{110\}$, $\{1\bar{1}0\}$, and $\{010\}$. The mineral splits easily parallel to $\{010\}$, and hence there is both parting and cleavage parallel to this face. The extinction angle on the (010) face is about 20°.

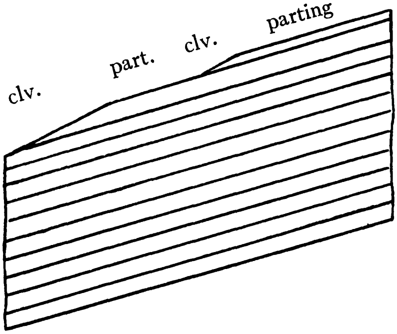

FIG. 5.—Albite-oligoclase, Ab_6An_1

Pericline parting was also noticed on a specimen of oligoclase from Bamle, Norway. A cover-glass was cemented to the dull parting surface and the angle between it and the cleavage was found to be +3° 50′, measuring with the contact goniometer. This measurement places the feldspar as about Ab_3An_1, which is confirmed by the extinction angle of 0° on the (010) cleavage face.

For another plagioclase from Labrador, showing well-defined pericline twinning and only faint albite twinning, the cleavage and the parting are parallel, as nearly as can be judged. Even in this case there is lamellar structure due to pericline parting. According to Penfield and Sperry[1] the angle of the rhombic section for Ab_1An_1 is ±0°. This places the feldspar as andesine-labradorite, which is confirmed by the extinction angle of −15° on (010).

PRISMATIC CLEAVAGE IN THE FELDSPARS

Labradorite from Labrador also occasionally shows dull surfaces due to pericline twinning. These dull surfaces are almost parallel to the cleavage, but careful measurement with the reflection goniometer proves the angle between the cleavage and the parting (using a cover-glass on the latter) to be about −3° 40′

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[1] *Am. Jour. Sci.*,(3) XXXIV, 390 (1887).

(average of $4^\circ\ 5'$ and $3^\circ\ 15'$). This proves the labradorite to be about $Ab_2\,An_3$. Fig. 6 is a side elevation of this labradorite.

The imperfect cleavage parallel to the unit form {110} or {110} and $\{1\bar{1}0\}$ in the feldspars has not been sufficiently emphasized. It is present in nearly every specimen of the common feldspars which I have examined and is a valuable aid in orienting cleavages and imperfect crystals. Were it not for the prismatic cleavage, it would often be impossible to orient the feldspar and hence to determine the kind of feldspar. Even when not distinct, its intersection with (010) gives the direction of the *c*-axis.

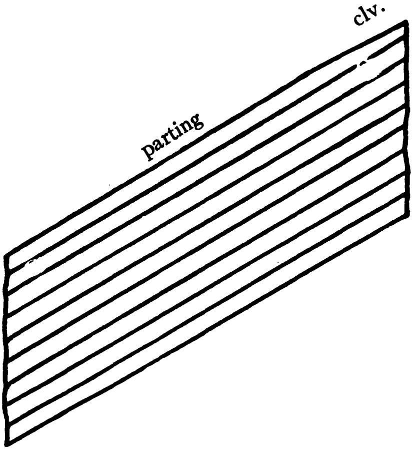


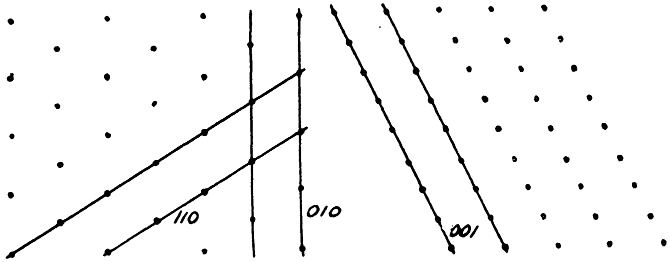
Fig. 6.—Labradorite, Ab_2An_3

That this plane of separation is cleavage and not parting is probable from a consideration of the internal structure of orthoclase. There are two possible space-lattices for monoclinic crystals, the monoclinic parallelepiped and the clinorhombic prism. The latter fits orthoclase better, as can be seen from Figs. *7a* and *7b*. According to Bravais, cleavage is parallel to the faces of greatest density, that is, those with molecules most closely packed. From the figures it can be seen that cleavage in orthoclase must be parallel to the {001}, {010}, and {110} forms, for the distance between adjacent rows of molecules is greatest for these directions.

The other feldspars evidently have almost the same structure as orthoclase. The separation parallel to the unit forms {110} and $\{1\bar{1}0\}$ is cleavage rather than parting, though there may also be parting in the same direction in addition. Thus in the albite from Auburn, Me., and in oligoclase from New York City, the surfaces parallel to (110) and $(1\bar{1}0)$ are coated with minute scales of sericite and the surfaces are rather dull.

SUMMARY

A peculiar intergrowth of microcline and albite is described. The albite plates are parallel to the unit prism faces. Plates parallel to (110) are in twinning position (albite twinning) with respect to the plates parallel to $(1\bar{1}0)$. The term perthite may be extended to include any regular intergrowth of albite with orthoclase or microcline, either of the latter being in excess (antiperthite when albite is in excess).



7a—Plan 7b—Side elevation

FIG. 7.—The space-lattice of orthoclase

Lamellar albite with easy planes of separation parallel to the side pinacoid {010} are explained by a parting in this direction. Here we have cleavage and parting in the same direction, and the variation in the side pinacoidal cleavage often noted in the literature may thus be explained.

Several kinds of plagioclase varying from albite to labradorite, and including $Ab_{12}An_1$, Ab_6An_1, Ab_3An_1, Ab_1An_1, and Ab_2An_3, show parting parallel to the rhombic section due to polysynthetic pericline twinning. The surfaces are dull and make slight angles with the cleavage surfaces. In these specimens we have examples of parting which are not parallel to either actual or possible crystallographic faces. As far as I know similar cases have not been recorded.

The imperfect separation in the feldspars parallel to the (110) and $(1\bar{1}0)$ faces is cleavage rather than parting. This cleavage is almost universally present and is of great assistance in orienting feldspar cleavages.